Remarks

Reconsideration of this Application is respectfully requested.

Upon entry of the foregoing amendment, claims 1-53 are pending in the application, with 1, 18, 35, 52, and 53 being the independent claims. New claims 37-53 are sought to be added. Claims 1-15, 17-25, 27-32, and 34-36 are sought to be amended. These changes are believed to introduce no new matter, and their entry is respectfully requested.

Based on the above amendment and the following remarks, Applicants respectfully request that the Examiner reconsider all outstanding objections and rejections and that they be withdrawn.

Allowable Subject Matter

Applicants appreciate the Examiner's indication that claims 8 and 24 are allowable. Claims 8 and 24 have been rewritten in independent form as new independent claims 52 and 53, respectively, by including the limitations of their base and intervening claims. As such, Applicants respectfully request that the Examiner acknowledge the allowance of these claims.

Objection to the Title

The Title of the Application has been objected to as not being descriptive. Accordingly, Applicants submit a new title, as shown above, to appropriately describe

the invention. As such, Applicants respectfully request that the objection be withdrawn.

Objections to the Drawings

The drawings are objected to under 37 CFR 1.83(a). The Examiner asserts that the feature "circumferential surface between the first and second drop-in heat spreader surfaces" is not shown in the drawings. Applicants respectfully traverse this objection.

The feature referred to by the Examiner is recited in claim 15. This feature is described in the specification on page 14, lines 5 and 6, as circumferential surface 314, and is illustrated in FIG. 3B. As stated in the specification, "[a] circumferential surface 314 extends around heat spreader 300 between first surface 304 and second surface 306." As indicated by the corresponding double-headed arrow shown in FIG. 3B, circumferential surface 314 extends around heat spreader 300. Hence, Applicants assert that the feature referred to by the Examiner is shown in the drawings.

In light of the above, Applicants believe that no corrections to the drawings are necessary. As such, Applicants respectfully request that this objection be withdrawn.

Rejections under 35 U.S.C. § 102

Claims 1-3, 9, 10, 12-14, 16-19, 25-27, 29-31 and 33-36 were rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent 6,184,580 to Lin (hereinafter Lin). Applicants respectfully traverse the rejection, and request that it be withdrawn.

Lin describes a ball grid array package with conductive leads. A silicon chip 20

is attached to a bottom surface of a first heat sink 26. Conductive leads 36 are attached to the bottom surface of the first heat sink 26 by an adhesive layer 38. Conductive leads 36 and a substrate 35 are attached together using an adhesive layer 40. As stated in Lin, "[t]he conductive leads 36 are sandwiched between the first heat sink 26 and the substrate 35. Conductive leads 36 are used to conduct heat generated by silicon chip 20 to a printed circuit board (PCB) (col. 3, line 62-col. 4, line 23 of Lin).

Technical differences exist between Lin and the present invention. In Lin, conductive leads 36 are coupled between first heat sink 26 and substrate 35. Furthermore, a first adhesive layer 38 separates conductive leads 36 from first heat sink 26, and a second adhesive layer 40 separates conductive leads 36 from substrate 35. Hence, first heat sink 26 and substrate 35 are not directly coupled together. This is different from the present invention. Claim 1 of the present invention recites that the first surface of the substrate is attached to the second surface of the stiffener. Hence, the stiffener and substrate of the present invention are coupled together, as opposed to Lin, wherein first heat sink 26 and substrate 35 are separated at least by conductive leads 36. Note that as a result of the configuration of Lin, the thermal path to a PCB provided by first heat sink 26 from silicon chip 20 is through conductive leads 36, and not substantially through substrate 35, which is very different from the present invention.

Hence, Lin does not disclose, teach, or even suggest the first surface of the substrate being attached to a surface of the stiffener, as recited in independent claim 1. Accordingly, Applicants respectfully submit that claim 1 is patentable over Lin for at least the reasons described above. Furthermore, Applicants submit that independent claims 18 and 35, which were similarly rejected, are also patentable over Lin. Applicants

further submit that claims 2, 3, 9, 10, 12-14, 16, 17, 19, 25-27, 29-31, 33, 34, and 36, and new claims 37-51, which depend therefrom, are likewise patentable over Lin. As such, Applicants respectfully request that the rejection of these claims be withdrawn.

Rejections under 35 U.S.C. § 103

Claims 4-7 and 20-23

Claims 4-7 and 20-23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin in view of Huang (US 2001/0045644 A1) (hereinafter Huang). Applicants respectfully traverse the rejection, and request that it be withdrawn.

As described above, Lin does not teach or even suggest all of the subject matter of claims 1 and 18. Applicants further submit that Huang does not supply the missing teachings of Lin. Accordingly, Applicants respectfully submit that claims 4-7 and 20-23, which depend from claims 1 and 18, are patentable over Lin and Huang taken alone or in combination. As such, Applicants respectfully request that the rejection of these claims be withdrawn.

Claims 11, 15, 28, and 32

Claims 11, 15, 28, and 32 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Lin. Applicants respectfully traverse the rejection, and request that it be withdrawn.

As described above, Lin does not teach or even suggest all of the subject matter of claims 1 and 18. Accordingly, Applicants respectfully submit that claims 11, 15, 28,

and 32, which depend from claims 1 and 18, are patentable over Lin. As such, Applicants respectfully request that the rejection of these claims be withdrawn.

Other Matters

Applicants note that the claims were amended to remove the word "drop-in" to more broadly recite the heat spreader of the present invention, and were amended to remove the words "/heat spreader" to more broadly recite the stiffener of the present invention. Applicants also note that claims 1-15, 17-25, 27-32, and 34-36 were amended to clarify antecedent basis and/or to correct other minor informalities. Therefore, the amendments to these claims do not create an estoppel.

Conclusion

All of the stated grounds of objection and rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding objections and rejections and that they be withdrawn. Applicants believe that a full and complete reply has been made to the outstanding Office Action and, as such, the present application is in condition for allowance. If the Examiner believes, for any reason, that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at the number provided.

Prompt and favorable consideration of this Amendment and Reply is respectfully requested.

Respectfully submitted,

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Version with markings to show changes made

1.(Amended) A ball grid array (BGA) package, comprising:

a stiffener[/heat spreader];

a substrate that has a first surface and a second surface, wherein said substrate has a central window-shaped aperture that extends through said substrate from said first [substrate] surface of said substrate to said second [substrate] surface of said substrate, wherein said first [substrate] surface of said substrate is attached to a surface of said stiffener[/heat spreader], and wherein a portion of said surface of said stiffener[/heat spreader] is accessible through said central window-shaped aperture;

an IC die that has a first surface and a second surface, wherein said first surface of said IC die surface is mounted to said accessible portion of said surface of said stiffener[/heat spreader]; and

a [drop-in] heat spreader [that has a surface that is] mounted to said second surface of said IC die [surface].

2. (Amended) The package of claim 1, further comprising:

a plurality of solder balls attached to said second surface of said substrate [surface].

3. (Amended) The package of claim 1, wherein said [drop-in] heat spreader is configured to dissipate heat generated by said IC die.

4. (Amended) The package of claim 1, wherein said second surface of said IC die [surface] includes a contact pad, further comprising:

a wire bond that couples said contact pad to said [drop-in] heat spreader.

5. (Amended) The package of claim 1 [4], wherein a [second] surface of said [drop-in] heat spreader is configured to be attached to a printed circuit board.

6. (Amended) The package of claim 4 [5], wherein said contact pad is a ground contact pad, and wherein said [drop-in] heat spreader operates as a ground plane.

7. (Amended) The package of claim 4, wherein said first surface of said [drop-in] heat spreader is planar, wherein said [drop-in] heat spreader has a second planar surface, wherein said first and said second planar surfaces are substantially parallel to each other, wherein said [drop-in] heat spreader has a ridge around at least a portion of its circumference such that an area of said first planar surface is greater than that of said second planar surface.

8. (Amended) The package of claim 7, wherein said wire bond attaches to said ridge of said [drop-in] heat spreader.

9. (Amended) The package of claim 1, wherein said stiffener[/heat spreader] includes a central cavity in said surface of said stiffener [/heat spreader surface], wherein said central cavity forms at least a portion of said accessible portion of said surface of said stiffener [/heat spreader], wherein said IC die is mounted [to said stiffener/heat spreader] in said central cavity.

10. (Amended) The package of claim 1, wherein said surface of said stiffener[/heat spreader surface] is substantially planar, and wherein said accessible portion of said surface of said stiffener[/heat spreader] is centrally located on said surface of said stiffener[/heat spreader surface].

11. (Amended) The package of claim 1, wherein said IC die is mounted to said surface of said stiffener[/heat spreader] with a first epoxy layer, and wherein said [drop-in] heat spreader is mounted to said IC die with a second epoxy layer.

12. (Amended) The package of claim 1, wherein an area of said second surface of said IC die [surface] is greater than an area of a surface of said [drop-in] heat spreader,

and wherein said [drop-in] heat spreader is configured to mount to the center of said second surface of said IC die [surface].

13. (Amended) The package of claim 1, wherein said IC die and said [drop-in] heat spreader are encapsulated.

14. (Amended) The package of claim 1, wherein said IC die and a portion of said [drop-in] heat spreader are encapsulated, wherein a second surface of said [drop-in] heat spreader is exposed.

15. (Amended) The package of claim 14, wherein said [drop-in] heat spreader includes a circumferential surface between said first and said second surfaces of said [drop-in] heat spreader [surfaces], wherein said circumferential surface is at least partially exposed.

17. (Amended) The package of claim 1, wherein said stiffener [/heat spreader] and said [drop-in] heat spreader have the same thermal expansion coefficient.

18. (Amended) A method of assembling a ball grid array (BGA) package, comprising the steps of:

providing a substrate that has a first surface and a second surface, wherein the substrate has a central window-shaped aperture that extends through the substrate from the first [substrate] surface of the substrate to the second [substrate] surface of the substrate;

providing a stiffener[/heat spreader];

attaching a surface of [the] a stiffener[/heat spreader] to the first [substrate] surface of the substrate, wherein a portion of the surface of the stiffener[/heat spreader] is accessible through the central window-shaped aperture;

mounting a first surface of an IC die to the accessible portion of the surface of the stiffener[/heat spreader]; and

mounting a surface of a [drop-in] heat spreader to a second surface of the IC die.

19. (Amended) The method of claim 18, further comprising the step of:

attaching a plurality of solder balls to the second [substrate] surface of the substrate.

20. (Amended) The method of claim 18, wherein the second IC die surface includes a contact pad, further comprising the step of:

coupling the contact pad to the [drop-in] heat spreader with a wire bond.

21. The method of claim 20, further comprising the step of:

configuring a second surface of the [drop-in] heat spreader to be attached to a printed circuit board.

22. (Amended) The method of claim 21, wherein the contact pad is a ground contact pad, further comprising the step of:

coupling the ground contact pad to the [drop-in] heat spreader with the wire bond, wherein the [drop-in] heat spreader operates as a ground plane.

23. (Amended) The method of claim 20, wherein said [drop-in] heat spreader mounting step comprises the step of:

providing a [drop-in] heat spreader that has a first planar surface, wherein the [drop-in] heat spreader has a second planar surface, wherein the first and the second planar surfaces are substantially parallel to each other, wherein the [drop-in] heat spreader has a ridge around at least a portion of its circumference such that an area of the first planar surface is greater than that of the second planar surface.

24. (Amended) The method of claim 23, wherein said contact pad coupling step comprises the step of:

attaching the wire bond to the ridge of the [drop-in] heat spreader.

25. (Amended) The method of claim 18, wherein said stiffener[/heat spreader] providing step comprises the step of:

forming a central cavity in the surface of the stiffener[/heat spreader surface], wherein the central cavity forms at least a portion of the accessible portion of the surface of the stiffener[/heat spreader].

27. (Amended) The method of claim 18, wherein said [drop-in] heat spreader mounting step comprises the step of:

providing a [drop-in] heat spreader that is substantially planar, wherein the surface of the stiffener is substantially planar, wherein the accessible portion of the stiffener[/heat spreader] is centrally located on the substantially planar stiffener[/heat spreader] surface.

28. (Amended) The method of claim 18, wherein said IC die first surface mounting step comprises the step of:

mounting the first surface of the IC die [first surface] to the stiffener[/heat spreader] with a first epoxy layer, wherein the [drop-in] heat spreader is mounted to the IC die with a second epoxy layer.

29. (Amended) The method of claim 18, wherein an area of the second surface of the IC die [surface] is greater than an area of [a] the surface of the [drop-in] heat spreader, further comprising the step of:

configuring the [drop-in] heat spreader to mount to the center of the second IC die surface.

30. (Amended) The method of claim 18, further comprising the step of:

encapsulating the IC die and the [drop-in] heat spreader.

31. (Amended) The method of claim 30, wherein said encapsulating step comprises the step of:

exposing a second surface of the [drop-in] heat spreader through an encapsulant material.

32. (Amended) The method of claim 31, wherein said exposing step comprises the step of:

exposing at least a portion of a circumferential surface of the [drop-in] heat spreader through the encapsulant material.

34. (Amended) The method of claim 18, further comprising the step of:

matching a thermal expansion coefficient of the stiffener[/heat spreader] to the thermal expansion coefficient of the [drop-in] heat spreader.

35. (Amended) A system for assembling a ball grid array (BGA) package, comprising:

[means for providing] a substrate that has a first surface and a second surface, wherein the substrate has a central window-shaped aperture that extends through the substrate from the first substrate surface to the second substrate surface;

[means for providing] a stiffener[/heat spreader];

means for attaching a surface of the stiffener[/heat spreader] to the first substrate surface, wherein a portion of the stiffener[/heat spreader] is accessible through the central window-shaped aperture;

means for mounting a first surface of an IC die to the accessible portion of the stiffener[/heat spreader]; and

means for mounting a surface of a [drop-in] heat spreader to a second surface of the IC die.

36. (Amended) The system of claim 35, wherein the substrate is a tape substrate[, wherein said substrate providing means comprises:

means for providing the tape substrate].

Claims 37-53 are new.